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# POSSIBILITY FOR WOOD-PRESERVATION INDUSTRY IN ARIZONA<sup>x</sup>

By L. A. Mueller and E. S. Kotok



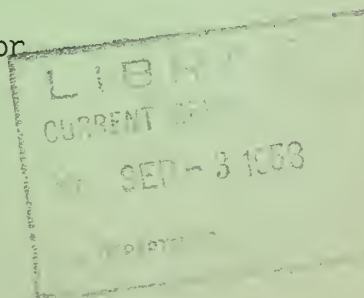
A Pole Stand on The Prescott National Forest

U. S. DEPARTMENT OF AGRICULTURE  
FOREST SERVICE

Southwestern Forest and Range Experiment Station

<sup>5a</sup>Tucson, Arizona

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This report was prepared by the Forest Utilization Service of the Southwestern Forest and Range Experiment Station, U. S. Forest Service, for the purpose of showing the need and the industrial opportunity for a wood-preservation industry in Arizona. The information is based on a careful on-the-ground study of the resources and markets in the region.

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## POSSIBILITY FOR WOOD-PRESERVATION INDUSTRY FOR ARIZONA

By L. A. Mueller and E. S. Kotok, Technologists,  
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### THE AREA

In Arizona and New Mexico there is a belt of ponderosa pine timber totalling  $6\frac{1}{2}$  million acres. The Prescott National Forest lies near the west-central portion of this timbered zone and is composed mainly of an even-aged stand of pine timber now about 70 years old (fig. 1). The terrain within this area is generally moderate, broken by numerous steep, rocky ridges and valleys.

Prescott, a city of 10,000 population, is centrally located in the area. It is the county seat of Yavapai County in which the Prescott National Forest is located. Mining and a limited amount of lumbering are the present industrial activities. The area is traversed by major north-south highways and the Santa Fe Railroad.

### THE MARKET

The present markets for preservative-treated products within Arizona and New Mexico consist largely of poles, fence posts, highway posts, mine timbers, and railroad ties. With a rapidly increasing population and a marked trend toward more intensified land-management practices, it appears that the present market will be broadened to include a wider assortment and greater volume of treated products. At the present time, the market requirements are met by plants located elsewhere as there are no commercial treating plants in the area.

The current estimated annual volume of the various types of poles and posts marketed in the area is shown in table 1.

Table 1.--Estimated annual volume of poles and posts marketed

Product	: :	Annual demand
Transmission poles		6,000- 8,000
Telephone poles		20,000- 25,000
Highway posts		15,000
Fence posts		750,000-1,000,000

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<sup>1/</sup>Maintained by the Forest Service, U. S. Department of Agriculture, for Arizona, New Mexico, and west Texas, with headquarters in Tucson, Arizona.



Most mine timbers and all railroad ties presently are being treated by company-owned or leased plants.

Transmission and telephone poles are generally purchased by American Standards Association classes. Class 5-30 foot is a popular size for transmission poles; classes 6 and 7 in 20- and 25-foot lengths are the most common for telephone poles. The principal consumers of transmission-line poles are the Arizona Public Service Corporation in Phoenix; Tucson Gas, Electric Light, and Power Company in Tucson; and the Public Service Corporation of New Mexico in Albuquerque. Most of the telephone poles are purchased by the Western Electric Corporation, Denver.

Highway posts are purchased by both the Arizona and New Mexico Highway Departments. Specifications for these posts, which generally run from 6 to 8 inches minimum diameter and 5 to 6 feet long, can be obtained from the respective State offices.

Common fence posts are sold by jobbers and retailers throughout the area, the most common specifications being 3 to 4 inches minimum top diameter and 6 to 7 feet in length.

Although the production of a diversified group of products should be the ultimate aim of a preservation plant, pole production possibilities are generally considered the best criteria for evaluating the opportunities for the establishment of such a plant. A common practice, where poles are involved, is to consider the production of the more competitive products such as fence posts or railroad ties of secondary importance and fit them into the operation during periods of low pole production. It is for this reason that the major portion of this report deals with the production of poles.

## THE RESOURCE

### Quality

The Prescott National Forest contains 43,000 acres of operable, nearly even-aged pole-sized ponderosa pine timber. The trees, in general, have good height and are straight with moderate taper. From a conformation standpoint, a high percentage is suitable for transmission and telephone-line poles. The most common disqualifying defects, based on American Standard Specifications, are the number and size of limbs and decay. In estimating the available volume of poles in the area, only those poles that conformed to the above specifications were tallied.

Ponderosa pine has long been approved by the American Standards Association as a pole species. In the strength classification system used by the Association, it is placed in the



FIG. 1— THE LOCATION OF

THE PRESCOTT NATIONAL FOREST

IN RELATION TO

THE COMMERCIAL FOREST AREA OF ARIZONA



THE PRESCOTT N.F.

THE COMMERCIAL FOREST AREA





6,000-pound fiber-stress group. This compares to 5,600 pounds for western red cedar, long considered the ultimate in pole species. Its light weight and soft texture place it in high favor with construction and maintenance crews. Like all pines, ponderosa has low natural decay resistance and must be preservative treated for satisfactory pole service. Because of the characteristically deep sapwood, the species can be readily treated to meet the necessary penetration and retention standards of the industry.

A defect common to ponderosa pine in the Southwest is red rot (Polyporous anceps). To determine the extent of this decay in the pole stands of the Prescott National Forest a separate study was made by the Division of Forest Pathology, Bureau of Plant Industry, Soils, and Agricultural Engineering.<sup>2/</sup> The study revealed that 27 percent of the poles were infected with this decay. The infections were found to be characteristically small, averaging less than 2 percent of the cross-sectional area and consequently not considered important from the standpoint of strength. The decay was visible on the top or butt section on about 7 percent of the poles. It is believed that this type of decay becomes inactive once a pole is cut and seasoned, consequently failure to detect all infection would not reduce the serviceability of the poles.

### Volume

#### Poles

Survey of the pole stands on the Prescott National Forest shows that there are approximately 44 poles per acre, considering all classes, suitable for cutting. Of the total, there are approximately 18 poles per acre between 20 and 25 feet in length and 23 per acre 30 feet and longer. The longest pole sampled in the survey was 70 feet. All lengths are estimated to a 5-inch top outside bark.

A summary of the most popular type transmission poles available per acre by class and length is shown in table 2.

A summary of the average number of poles per acre by diameter and length classes to a 3.8-inch top diameter inside bark is shown in table 3. Three and two-tenths percent of the poles are Douglas-fir. From these data estimates can be made for poles of specific class and length. Since an indefinite number of poles could be produced from any single tree, varying in both length and class as the position of cut varies, it seems impractical to tabulate this composite array.

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<sup>2/</sup>Andrews, Stuart R. Western Red Rot in Pole Stands of the Prescott National Forest. Div. For. Path., B.P.I.S. & A.E., Albuquerque, N.Mex. Report. 1952.

Table 2.--Transmission poles available per acre

A.S.A. class	:	Length	:	Average No. of poles
	:	(Feet)	:	available per acre
4		35 or larger		1.2
5		30 "		4.5
6		35 "		3.2
6		30 "		5.3
7		30 "		9.0
				23.2

Table 3.--Average poles per acre available for cut, Prescott National Forest

Diam.:	Length														
o.b. :															
at 7':	16	18	20	22	25	30	35	40	45	50	55	60	65	70	
(In.)	(Ft)	(Ft)	(Ft)	(Ft)	(Ft)	(Ft)	(Ft)	(Ft)	(Ft)	(Ft)	(Ft)	(Ft)	(Ft)	(Ft)	(Ft)
7	0.99	0.99	1.33	0.88	1.18	0.20	0.05								
8	0.64	0.34	1.43	1.18	1.88	0.84	0.24	0.05							
9	0.49	0.54	0.94	0.94	1.98	1.78	0.99	0.34	0.05	0.05					
10	0.30	0.15	0.74	0.94	1.73	2.02	1.63	0.74	0.10						
11	0.05	0.05	0.10	0.34	0.74	1.58	1.28	0.69	0.44						
12	0.05	0.10	0.15	0.05	0.64	0.94	1.58	0.44	0.34	0.34		0.05			
13			0.05	0.05	0.25	0.20	0.49	0.49	0.30	0.25					
14				0.05		0.05	0.15	0.30	0.30	0.10	0.05	0.15			
15		0.05				0.05	0.05		0.20	0.25	0.10	0.05			
16							0.10	0.05	0.15	0.10	0.10		0.10		
17															
18										0.15	0.05	0.05			
19															
20															0.05
	2.52	2.22	4.74	4.43	8.40	7.66	6.56	3.10	1.88	1.24	0.30	0.30	0.10	0.05	

43.50

An extract of American Standards Association specifications for wood poles showing only that portion of the ponderosa pine schedule deemed pertinent for this area is shown in table 4. Dimensions are expressed in terms of diameter rather than circumference for ease of use.



A typical pole stand on the Prescott National Forest.  
The banded trees would be among those removed on an early pole cut.





Table 4.—American Standard Association dimensions for ponderosa pine poles (fiber stress 6,000 pounds per square inch)

Class	: 1	: 2	: 3	: 4	: 5	: 6	: 7
Minimum diameter :							
i.b. at top (in.):	8.6	7.8	7.3	6.7	6.0	5.4	4.8
Length of pole :							
(ft.)	:Minimum diameter inside bark at 6 feet from butt (in.)						
30	12.7	11.9	11.1	10.3	9.5	8.9	8.3
35	13.5	12.7	11.9	11.0	10.2	9.5	8.8
40	14.3	13.5	12.6	11.6	10.8	10.0	9.4
45	15.1	14.2	13.2	12.2	11.4	10.5	9.9
50	15.8	14.8	13.8	12.7	11.9	11.0	10.2

Note: No values are shown for classes 8, 9, and 10 nor for poles of lengths less than 30 or more than 50 feet.

#### Posts

In addition to the poles shown in table 2, there are 35 fence posts per acre that could be removed from the growing stock. This is in addition to the number that normally can be harvested from the tops of trees cut for poles. The fence posts available are of suitable size and quality to meet the post market requirements in the region.

#### Sawtimber

There are approximately 90,000 M board feet of sawtimber on the area in addition to pole trees. This material is largely in trees that are either too large or otherwise unsuited for poles and which, for silvicultural reasons, should be removed.

#### TREATING PLANT

On the basis of available resources and markets, it appears that a plant with a minimum capacity of at least 10,000 poles per year should be considered. A plant of this size would be large enough to accommodate the current regional pole and post needs of the sizes the resource will provide, with sufficient surplus to accommodate new products that might be added as the operation develops.

Either a pressure plant or hot-and-cold-bath nonpressure plant might be considered. Each has its advantages and disadvantages. Generally speaking, pressure plants provide more plant control, are more conservative with expensive treating oils, and are more versatile, an important factor with thick-sapwood species.



Pressure-treated products also command a wider market but are more expensive to install. Nonpressure plants, on the other hand, can be adapted more readily to small operations, carry lower fixed charges, and can produce both full-length- and butt-treated products. This method, however, is extravagant with treating oil and products so treated are restricted to less severe use conditions. Perhaps the biggest disadvantage in the nonpressure method is that a number of important wood-treating specifications will not permit nonpressure treatment of thick-sapwood species such as ponderosa pine and southern pine. Federal specifications TT-W-571C, AWPAC-4, R.E.A. Eng., Memo. 133R3, and those of the Bell System are examples of such specifications.

### Plant Cost

Treating-plant costs vary considerably according to type, capacity, and completeness.

A pressure-treating plant designed for a minimum annual capacity of 10,000 poles, with maximum length of 40 feet, including essential operating and power-plant equipment, will cost approximately \$50,000 installed.

A nonpressure or hot-and-cold-bath system of similar capacity will cost approximately \$25,000 installed.

The above estimates do not include bark peelers or other yard equipment which would add another \$10,000 or \$15,000, depending upon the mechanization desired.

A partial list of treating-plant manufacturers and consulting engineers is attached.

### FOREST MANAGEMENT

With the exception of patented mining claims, most of the timber is within national forests. The timber on these lands is managed on a sustained-yield basis which anticipates periodic cuts in keeping with the growing capacity of the lands. The needs for early cuts are recognized and stumpage can be made available. The cost of stumpage will be determined by fair-appraisal methods based upon the market value of the raw material less the costs involved in logging, development of areas, and protection of the reserve stand. Poles are usually sold by the linear foot. Posts and other such items are sold by the piece or cord. Saw logs which will be developed during the cutting program are sold by the board-foot log scale Scribner Decimal C, the standard Forest Service practice.

Application for purchase of timber is followed by an appraisal and competitive sale as required by existing statutes. After stumpage has been sold, administration of the sale is by

forest officers as provided for in the sale contract. Trees marked for removal on designated areas will be removed on a cutting schedule agreed upon by the operator and the Forest Service. Roads or other developments agreed upon in the contract will be constructed by the operator per schedule. Utilization standards and protection of the reserve stand will be adhered to by the operator.

Questions about sales procedure should be referred to the forest supervisor, Prescott National Forest, Prescott, Arizona.

#### FINANCIAL ASPECTS

Properly managed preservation plants elsewhere have returned adequate profits on invested capital in the past and there is reason to believe a plant in central Arizona also would be profitable. Aspects such as personal skill and resourcefulness, enterprise, and salesmanship, or future conditions of the market are impossible to evaluate. The following cost analysis is based upon averages from similar operations elsewhere:

For a pressure plant costing approximately \$50,000 with a capacity of at least 10,000 poles per year, and applying a treatment of 8 pounds per cubic foot, the treating costs would average \$2.48 per pole. The average pole produced would contain about 72 board feet. To this treating cost must be added the cost of the untreated pole.

An itemized breakdown of the foregoing treating cost is as follows:

	<u>Cost per average pole</u>	
Handling (before and after treatment)	\$1.08 -	\$1.65
Treating	.22	.29
Repairs	.58	.72
Steam	.01	
Preservative analysis	.02	
Depreciation on equipment (15%/yr.)	.14	.22
Total	<u>\$2.05 -</u>	<u>\$2.91</u>
Average cost		\$2.48

The probable cost of untreated poles is indicated by recent OPS ceiling prices (CPR 126) which for untreated peeled western poles are as follows:

<u>Length</u>	<u>Class</u>	<u>Price per pole</u>
25 feet	4	\$4.50
	5	4.25
	6	3.88
	7	3.62
30 "	4	8.40
	5	5.85
	6	5.40
	7	4.95
35 "	4	11.20
	5	7.88
	6	7.35
	7	6.30

Using a class 5-30' as a probable average pole that would be produced in the Prescott Working Circle with an OPS ceiling of \$5.85 and adding the costs for special loading, framing, gaining, and branding, amounts to an aggregate average cost of \$8.72 per untreated pole delivered at the treating plant. This amounts to a combined cost for the average treated pole of \$11.20 f.o.b. plant not including profit and sales costs.

Costs for ponderosa pine poles are compared with quoted prices for selected classes of Douglas-fir and lodgepole pine poles in table 5.

Table 5.--Quoted prices for Douglas-fir and lodgepole pine poles and estimated prices for ponderosa pine poles f.o.b. Tucson

Class	: Douglas-fir : f.o.b. Tucson : (quoted)	: Lodgepole pine : f.o.b. Tucson : (quoted)	: Ponderosa pine : f.o.b. Tucson : (estimated) <sup>1/</sup>
4-30	\$26.33	\$19.85	\$16.57
4-35	33.90	25.41	20.15
5-30	21.11	16.73	13.60
5-35	27.37	21.83	16.46
6-30	18.48	13.94	12.85
6-35	24.39	18.84	15.44
7-30	16.72	11.51	12.12
7-35	21.44	16.38	14.10

<sup>1/</sup>Not including sales costs or profit. Also, since no commodity rate now exists for poles moving from Prescott, an estimated 40¢ per cwt. is used.

As noted from the above prices, ponderosa pine poles should be able to compete price-wise with presently available poles of other species at current prices.

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Inquiries relating to the contents of this report should be addressed to Director, Southwestern Forest and Range Experiment Station, P. O. Box 951, Tucson, Arizona.





